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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/950,038	09/10/2001	Eitan Zait	22868.49	8658

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EXAMINER

ANGEBRANNDT, MARTIN J

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 06/06/2003

5

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/950,038

Applicant(s)

ZAIT ET AL.

Examiner

Martin J Angebrannt

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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1. The co-pending application 09/694429 has been allowed and is unavailable. The applicant should make a copy of this application of record to address and double patenting issues as well as exercising their duty of candor.

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 13-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In line 2 of claim 13, there are two commas.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-4 and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999).

Hongo et al. '759 teach the processing of photomasks to remove defects, where the laser passes through the transparent substrate and ablates the chrome layer. The apparatus is shown in figure 3 where the stage allows translation. The computer controls the stage, laser and the scanning gear. The backside irradiation is disclosed as preventing damage to the lens elements due to redeposition of the chrome (1/29-38). The backside irradiation also prevents alloying of

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the glass and metal (1/11-28). The back side irradiation is also disclosed as minimizing surface damage (roughness or pit formation) (1/43-50). The use of laser having pulsewidths of less than 20 nanoseconds is disclosed. (2/40-61). longer puldewidths are discloseed as exhibiting undersirable thermal effects. (7/62-8/16). an argon ion laser was used. (488, 514.5 nm output, 3/43)

Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) teach with respect to figure 7, as apparatus which uses a femtosecond laser to ablate chrome defects without thermal effects, particularly thermal damage to the adjacent substrate (see figure 4, page 3137, right column and page 3140, left column). The ablation threshold for quartz is disclosed as much higher than that of Cr. (page 3140, left column). The computer controls the focussing through the objective turret and the condenser assembly as well as the stage location. (page 3142, left column). The use of a Ti:sapphire laser with an 800 nm output is disclosed. The pulses are 10 femtoseconds long. (page 3141, left column)

The examiner has read the breadth of the claims to include repair of masks/reticles.

It would have been obvious to one of ordinary skill in the art to modify the process of Hongo et al. '759 by using the femtosecond lasers and computer controlled focusing of Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) to further decrease the thermal effects and allow the automation of the focusing as well with a reasonable expectation of gaining these advantages, particularly in view of the direction within Hongo et al. '759 to shorter laser pulses and/or it would have been obvious to one skilled in the art to modify the teachings of Haight et

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al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) by using the backside irradiation disclosed by Hongo et al. '759 to reduce the damage to the substrate, to reduce damage to the optics from redeposition of the chrome on the optics and alloying of the substrate and chrome with a reasonable expectation of success based upon the reference being in the same field of endeavor and the desirability of reducing unintentional damage to the substrate in both the references.

6. Claims 1-5 and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999), in view of Lou et al. '272.

Lou et al. '272 teach with respect to figures 2a-c, the use of AR films. The use of these in laser machining of chromium masks is disclosed. (7/10-23)

In addition to the basis provided above, the examiner holds that it would have been obvious to one skilled in the art to modify the combination of Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) by adding an AR coating as disclosed by Lou et al. '272 to be useful in laser machining of chromium masks.

7. Claims 1-4 and 9-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999), in view of Gelbart et al. '818.

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Gelbart et al. '818 teach ablation as a means for forming phase shift masks. In figure 4, the light absorbing polyimide layer (16) is placed beneath the overcoat (19). (3/53-63) In figure 5, a positive resist layer (20) is coated beneath the polyimide layer. (3/64-4/19). The prior art attempts to directly ablate chrome or polymer layers were hampered by the very short wavelengths required and the low repetition rate of the excimer lasers. The thickness of these layers is disclosed as facilitating a 180 degree phase shift ($\lambda/2n$) and may be in the range of 0.1 to 2 microns in thickness.

In addition to the basis provided above, the examiner holds that it would have been obvious to one skilled in the art to modify the invention of Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) by adding adjacent phase shifting layers to allow phase shift masks to be formed.

8. Claims 1-4,9-13,15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999), in view of Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337 and Okamoto '606.

Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337 teaches the use of laser machining to form phase shifting grating structures.

Okamoto '606 teaches the use of ion beams to etch both the metal layer and the substrate to form a phase shifting groove at the same time to save time. (18/47-52)

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In addition to the basis provided above, the examiner holds that it would have been obvious to one skilled in the art to modify the invention of Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) by using the laser disclosed by Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) as able to damage the substrate to form phase shifting grooves in the substrate in the manner taught by Zhang et al., "Study of microprocessing of glass", Proc. SPIE vol. 3933 pp. 332-337 to save time in photomask manufacture as taught by Okamoto '606.

This covers the embodiment shown in figure 3b of the instant specification, where the substrate is etched.

9. Claims 1-4, 6-12 and 19-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over James et al. '200 combined with Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999), in view of Jensen et al. '718.

James et al. '200 teaches with respect to figures 11,13 and 15, a laser source (10), such as a YAG laser, which is divided into separate beams as indicated in figure 11 and focussed by the microlens array (14), which may be shifted as indicated by indicia (12), with the arrows) and then the light is modulated using computer control using the transmissive device (26) shown in figure 13 or the reflective device (26a) shown in figure 15. The workpiece adjustment means (20a) shown in figure 1 also allows the workpiece to be shifted relative to the focus of the lenses.

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(5/8-19). The mask 22 or 22a may alternatively be computer controlled. (7/15-8/7). The individually controllable

Jensen et al. '718 (2/49-59) disclose the use of lasers to form masks.

It would have been obvious to one skilled in the art to modify the invention of James et al. '200 by providing computer control means for the stage holding the workpiece as taught by Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) with a reasonable expectation of gaining increased flexibility in forming the patterns and/or it would have been obvious to modify the invention of Hongo et al. '759 and Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) as discussed above by using beam division with independent control of the individual beams to increase productivity in forming masks as taught by Jensen et al. '718 without any thermal effects as discussed by Haight et al., "MARS:Femtosecond laser mask advanced repair system in manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999).

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Oprysko et al. '234, Grenon et al. '836, Hayden et al. '352, O'Connor et al. "Next generation laser based mask repair tool", Proc. SPIE vol. 1604 pp. 167-178 (1991) teach repair of photomask defects.

Haight et al., "Implementation and performance of a femtosecond laser mask repair system in manufacturing", Proc. SPIE vol. 3546, pp. 477-484, Shani et al., "high resolution near

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field mask repair with femtosecond laser and Haight et al. '485 disclose ultrashort laser pulses to correct photomasks.

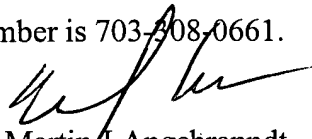
Wada et al. '991 (3/52-56) disclose the use of lasers to form masks.

Kirch et al. '772 and Ihleman et al. "Excimer laser ablation patterning of dielectric layers", Applied Surf. Sci., Vol. 86(1-4) pp. 228-233 (abstract only) teach that the damage threshold for chrome layers is less with backside irradiation. (3/7-17).

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Martin J Angebranndt whose telephone number is 703-308-4397. The examiner can normally be reached on Mondays-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



Martin J Angebranndt
Primary Examiner
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June 3, 2003